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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER

NADAV, ORI

ART UNIT PAPER NUMBER

2811

DATE MAILED: 03/01/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/683,985

Applicant(s)

VOLDMAN, STEVEN H.

Examiner

ori nadav

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 22 December 2003.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-38 is/are pending in the application.
- 4a) Of the above claim(s) 1-25 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 26-38 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 08 March 2002 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 3/19/02.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

Applicant's election without traverse of claims 26-38 is acknowledged.

Drawings

The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, at least one of said cathode and anode comprise a plurality of vertically abutting diffusion regions, as recited in claim 26, and a liner, as recited in claim 32, must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Specification

The abstract of the disclosure is objected to because the abstract recites a device, whereas the claims are directed to a method of making the device. Correction is required. See MPEP § 608.01(b).

The disclosure is objected to because of the following informalities: The term "minium", as recited on page 2, paragraph [0005] should read "minimum". The phrase

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"patent 4,734,271", as recited on page 1, paragraph [0004] should read "patent 4,736,271".

Appropriate correction is required.

Claim Objections

Claim 32 is objected to because of the following informalities: The phrase "formation of a liner and a deposition a fill material", as recited in claim 32, is unclear. Appropriate correction is required.

Claim 33 recites the limitation " said first doped region and said second doped region" in lines 2 and 3. There is insufficient antecedent basis for these limitations in the claim.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 26-38 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. There is no adequate description in the

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disclosure of at least one of a cathode and an anode comprising a plurality of vertically abutting diffusion regions, as recited in claim 26, in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 33-34 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The claimed limitations of forming a cathode further comprises the step of forming a third doped region disposed between first doped region and second doped region, as recited in claim 33, are unclear as to which regions are the first doped region and the second doped region.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 26, 28, 33, 35 and 37-38, insofar as in compliance with 35 U.S.C. 112, are rejected under 35 U.S.C. 102(b) as being anticipated by Beasom (5,841,169).

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Beasom teaches in figure 2 and related text a method of forming a diode, comprising the steps of: forming an anode 202 of a first conductivity type and a cathode 204 of a second conductivity type disposed below said anode on a substrate 201, wherein at least one of said cathode and anode comprise a plurality 207, 202 of vertically abutting diffusion regions; and forming a plurality of isolation regions 209, 219, said cathode and anode being disposed between adjacent ones of said plurality of isolation regions, said plurality of isolation regions extending deeper into said substrate than said cathode and said anode.

Regarding claim 28, Beasom teaches in figure 2 and related text isolation regions comprise a plurality of insulation-filled trenches having sidewalls that are tapered.

Regarding claim 33, Beasom teaches in figure 2 and related text the step of forming said cathode further comprises the step of forming a third doped region 206 disposed between said first doped region and said second doped region.

Regarding claim 35, Beasom teaches in figure 2 and related text the step of forming said anode comprises the steps of:

forming a first doped region 202 abutting said cathode; and

forming a second doped region 207 on a surface of said substrate, said second doped region having a higher concentration of dopant than said first doped region.

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Regarding claim 37, Beasom teaches in figure 2 and related text the steps of forming a plurality of diffusion regions 214, 215 of said second conductivity type on a surface of said substrate.

Regarding claim 38, Beasom teaches in figure 2 and related text the step of forming a plurality of second isolation regions 209, 219 that separate said plurality of diffusion regions from said cathode.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 29 and 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Beasom.

Regarding claim 29, Beasom teaches in figure 2 and related text teaches substantially the entire claimed structure, as applied to claim 26 above, except the step of forming a second doped region of said second conductivity type disposed below said first doped region and contacting said substrate, wherein said first and second doped regions having different dopant concentrations.

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Beasom teaches in figure 4 and related text the step of forming a cathode comprises forming a first doped region 403 of a second conductivity type abutting said anode 402; and forming a second doped region 404 of said second conductivity type abutting and disposed below said first doped region and contacting said substrate 401, said first and second doped regions having different dopant concentrations. It would have been obvious to a person of ordinary skill in the art at the time the invention was made to use the step of forming said cathode comprises forming a first doped region 204 of a second doped region of said second conductivity type abutting and disposed below said first doped region and contacting said substrate, wherein said first and second doped regions having different dopant concentrations in Beasom's device in order to minimize the isolation leakage of the device.

Although Beasom does not explicitly state that layers 407, 402, 403 and 404 form a diode, layers 407, 402, 403 and 404 form a PN junction, and thus forming a diode.

Regarding claim 31, Beasom teaches in figure 2 and related text isolation regions are formed by a process comprising the steps of etching said substrate to form trenches and depositing at least one insulator. Beasom does not teach removing portions of said insulator outside of said trenches. It would have been obvious to a person of ordinary skill in the art at the time the invention was made to remove portions of said insulator outside of said trenches in order to form the device as depicted in figure 2 of Beasom.

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Claims 27 and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Beasom in view of Mack et al. (4,736,271).

Regarding claim 27, Beasom teaches in figure 2 and related text teaches substantially the entire claimed structure, as applied to claim 26 above, except a plurality of insulation-filled trenches having sidewalls that are substantially vertical.

Mack et al. Teach in figure 11, a plurality of insulation-filled structures having sidewalls that are substantially vertical. It would have been obvious to a person of ordinary skill in the art at the time the invention was made to form the plurality of insulation-filled trenches of Beasom's device with sidewalls that are substantially vertical in order to simplify the processing steps of making the device.

Regarding claim 30, Beasom teaches in figure 2 and related text teaches substantially the entire claimed structure, as applied to claims 26 and 29 above, except forming a second pair of isolation structures between said adjacent isolation regions and said anode.

Mack et al. Teach in figure 11 forming a second pair of isolation structures 30 between said adjacent isolation regions 30 and anode 54, 60. It would have been obvious to a person of ordinary skill in the art at the time the invention was made to form a second pair of isolation structures between said adjacent isolation regions and said anode in Beasom's device in order to provide better electrical isolation for the anode.

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Claim 32 is rejected under 35 U.S.C. 103(a) as being unpatentable over Beasom in view of Takeuchi et al. (5,825,067).

Regarding claim 27, Beasom teaches in figure 2 and related text teaches substantially the entire claimed structure, as applied to claim 26 above, except forming a liner.

Takeuchi et al. teach in figure 3B forming a liner 4. It would have been obvious to a person of ordinary skill in the art at the time the invention was made to form a liner in Beasom's device in order to improve the electrical isolation capabilities of the isolation trench.

Claims 34 and 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Beasom in view of Robinson et al. (5,268,316).

Beasom teaches in figure 2 and related text teaches substantially the entire claimed structure, as applied to claims 26, 33 and 35 above, except a third doped region comprises a retrograde-doped region. Robinson et al. teach a third doped region comprises a retrograde-doped region (column 3, lines 36-47). It would have been obvious to a person of ordinary skill in the art at the time the invention was made to form a third doped region comprises a retrograde-doped region in Beasom's device in order to provide low-reverse leakage, a relatively low voltage turn-on, and low series resistance for the current path from the junction to the diode contact.

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Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. References C and D are cited as being related to bipolar transistors comprising isolation trenches.

Papers related to this application may be submitted to Technology center (TC) 2800 by facsimile transmission. Papers should be faxed to TC 2800 via the TC 2800 Fax center located in Crystal Plaza 4, room 4-C23. The faxing of such papers must conform with the notice published in the Official Gazette, 1096 OG 30 (November 15, 1989). The Group 2811 Fax Center number is (703) 308-7722 and 308-7724. The Group 2811 Fax Center is to be used only for papers related to Group 2811 applications.

Any inquiry concerning this communication or any earlier communication from the Examiner should be directed to *Examiner Nadav* whose telephone number is (703) 308-8138. The Examiner is in the Office generally between the hours of 7 AM to 4 PM (Eastern Standard Time) Monday through Friday.

Any inquiry of a general nature or relating to the status of this application should be directed to the **Technology Center Receptionists** whose telephone number is **308-0956**



O.N.
2/17/04

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PATENT EXAMINER
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